REMARKS

The specification has only been amended to correct grammatical errors and to conform to U.S. practice; no new matter has been added to the specification. The claims have only been amended to correct grammatical errors, to conform to U.S. practice, and to provide proper antecedent basis; no new matter has been added to the claims.

In the event that the specification and/or claims should require any further amendment, the kind assistance of the Examiner in entering an Examiner's amendment will be greatly appreciated.

Respectfully,

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Dated: New York, NY

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 2 OF PAGE 1 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 2 OF PAGE 1 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

[Description] Field of the Invention:

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 3 OF PAGE 1 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 3 OF PAGE 1 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

The invention relates to a device for measuring AC currents in the form of a current sensor according to the preamble **[to]** **of** claim **[for protection]** 1.

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 5 OF PAGE 1 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 5 OF PAGE 1 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

Description of the Prior Art

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 6 OF PAGE 1 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 6 OF

Inductive measuring procedures according to the Rogowski principle are known in the area of current measuring technology. In the known models, the current-carrying conductor is routed through a coil. The sensor coil can **[here]** vary in design. One design was described in DE 195 05 812 C2, in which an electrically insulating annular element is provided as the winding carrier. However, the disadvantage to this design is that production requires numerous different steps. Another disadvantage is that, when setting up a current sensor with an integrated electronic evaluation or calculation circuit, the coil in the form described in DE 195 05 812 C2 as a component in addition to the electronic components of the evaluation or calculation circuit have to be placed, secured and electrically connected. Therefore, the integration of this coil into an electronic evaluation or corrective calculation circuit is associated with a high space requirement and high costs for manufacturing the device as a whole. The additional requirement that sensors be miniaturized to make increasingly smaller models tailored to the respective application available cannot be met with a current acquisition coil according to DE 195 05 812 C2. In the description of another design according to US 5,414,400, the coil is fabricated directly on a printed circuit board using the printed conductors and through platings. Viewed in a radial direction, the printed circuit board segment between the through platings **[here]** forms the electrically insulating annular element or annular segment. The printed conductors are oriented in such a way that the respective printed conductor on the top of the printed circuit board ends in a through plating for establishing an electrical connection with a printed conductor on the bottom, while the latter in turn ends in a through plating for establishing an electrical connection with an additional printed conductor

on the top, thereby representing a winding around the insulating annular segment. The geometric orientation of the printed conductors yields a coil-like winding of the insulating annular segment, which, in its entirety, results in a current acquisition coil according to the Rogowski principle. The key disadvantage to the design described in US 5,414,400 is that the current-carrying conductor must also be routed through the borehole enveloped by the coil. As a result, a current acquisition coil given this design cannot be placed around a current-carrying conductor for purposes of current acquisition at a later time. Another disadvantage is that the coil as designed has a go-and-return type of winding. It is proposed that the current acquisition coil be built around a two-layer printed circuit board, whose windings are quite symmetrically arranged over the entirety, but the individual windings alternate in dimensions. This **[disadvantages]** **disadvantage** stems from the geometric requirement that the windings for practically two coils lying one inside the other be flatly accommodated on a printed circuit board.

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 19 OF PAGE 2 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 19 OF PAGE 2 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

The object of the invention is to realize an inexpensive, compact design for a device for measuring AC currents by means of a current acquisition coil based on a printed circuit board or a printed circuit board segment according to the Rogowski principle, which can at a

later point be placed around and encompass the current-carrying conductor without interrupting the function of the current-carrying conductor. The structure of the windings must **[here]** be very symmetrical in order to achieve a high measuring accuracy.

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 6 OF PAGE 3 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 6 OF PAGE 3 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

The device according to the invention for a current acquisition coil is realized with the help of a printed circuit board, which can be flipped open in such a way that the current-carrying conductor to be measured can **[also]** be inserted in the provided area of the coil without interrupting or deactivating the current-carrying conductor. The opened device for a current acquisition coil is closed for measurement in such a way that the current-carrying conductor is completely enclosed by the current acquisition coil, and the current acquisition coil can measure the current of the current-carrying conductor according to the Rogowski principle. To satisfy additional requirements on the current acquisition coil relating to symmetrical structure or compactness, a multi-layer printed circuit board must be used. This offers more ways in which to control the printed conductor, and enables the most symmetrical structure possible for the current acquisition coil winding.

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 17 OF PAGE 3 SHOWING ALL OF

THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 17 OF PAGE 3 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

The printed circuit board of the device for measuring AC currents is dimensioned in such a way that additional electronic components of an evaluation unit can be arranged thereupon. Relative to prior art, this makes it possible as a whole to dimension on a smaller scale and **be** more cost **[effectively]** **effective**. The evaluation unit can **[here]** perform a measured value conversion for conditioning measured value signals for open-loop and closed-loop controllers, running comparisons with limiting values and generating **[„]**"too-low" or **[„]**"too-high" messages, or for other applications.

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 12 OF PAGE 4 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 12 OF PAGE 4 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

[Captions to Figures] Brief Description of the Drawing

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 15 OF PAGE 4 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 15 OF PAGE 4 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

Fig. 2: The printed conductor progression for the coil segments involving the **[„]**"go" path (20) and the **[„]**"return" path (21) of the winding.

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 1 OF PAGE 5 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 1 OF PAGE 5 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

Fig.4: A variant of the device of the current acquisition coil as a single-piece printed circuit board with only one slot in the device, which can be placed around the conductor to be measured **[for to open] by opening** the printed circuit board via twisting.

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 7 OF PAGE 5 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 7 OF PAGE 5 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

[Embodiment] Detailed Description

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 8 OF PAGE 5 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 8 OF PAGE 5 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

Fig. 1 shows the arrangement according to the invention of a current sensor with a flip-open, annular printed circuit board as the current acquisition coil. The hinge 6 provides a flip-open link between the one printed circuit board half 1 and the second printed circuit board half

10. The current-carrying conductor 2 with its current to be measured is axially oriented and routed through the middle of the current acquisition coil. The printed conductors of the individual layers are not shown, but **are** alluded to with 4 and 5. The additional part of the printed circuit board 9 is preferably used to hold electric or electronic components for an evaluation circuit 19, which issues a scaled measuring signal to the output 13.

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 9 OF PAGE 6 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 9 OF PAGE 6 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

Fig. 3 shows the flip-open printed circuit board of the current acquisition coil in the flipped-open state for enveloping the current-carrying conductor 2. The printed conductor parts 1 and 10 are **[here]** flipped open and spread apart until the current-carrying conductor 2 fits through the arising gap 11, and the current sensor can be passed over the current-carrying conductor in the direction of the arrow. The hinge 6 must **[here]** permit the rotational movement of individual printed circuit board halves or only one printed circuit board half necessary to achieve a maximal gap width 11. Flexible conductors 12 are used to electrically connect one half of the current acquisition coil 1 in direct proximity to the hinge 6 with the other half of the current acquisition coil 10 with the help of electrical terminals 13 in the manner required for current acquisition according to the Rogowski principle.

MARKED UP VERSION OF THE REPLACEMENT PARAGRAPH BEGINNING ON LINE 3 OF PAGE 7 SHOWING ALL OF THE CHANGES RELATIVE TO THE PREVIOUS VERSION OF THE PARAGRAPH BEGINNING ON LINE 3 OF PAGE 7 PURSUANT TO *37 CFR § 121(b)(1)(iii)*

Fig. 5 shows a single-piece current acquisition coil on a multi-layer printed circuit board, in which the current-carrying conductor 52a, 54a is routed in an axial direction through the printed circuit board as a through plating 53. The terminals are **[here]** routed via the current-carrying printed conductor 52 to the incoming current-carrying conductor 52a, and via the current-carrying printed conductor 54 to the continuing current-carrying conductor 54a. To ensure that the current to be acquired is relayed in an axial direction through the printed circuit board, the current-carrying printed conductors and printed circuit board terminals 56 are arranged on the outside of the printed circuit board 1. In this configuration, the current-carrying conductor is hooked up to the external current-carrying conductor parts 52a and 54a via electrical connectors 56. A printed circuit board segment 9 not used for the coil is preferably used to hold electric or electronic components for an evaluation circuit 19, which issues a scaled measuring signal to the output 13. The arrangement shown on Fig.5 is particularly advantageous for permanently fixed current sensors, which are no longer moved around after installation.

VERSIONS WITH MARKINGS TO SHOW CHANGES TO CLAIMS 1-11 PURSUANT TO *37 CFR § 121(c)(1)(ii)*

1. *(amended)* A current acquisition coil according to the Rogowski principle with printed conductors (22, 23, 24, 25), whose configuration yields a coil winding (20, 21), and whose printed conductor ends are connected **[with]** **to** each other by through platings (26, 27, 28, 29) on **[the]** **a** printed circuit board (1, 10), **[characterized in that]** **wherein** the current acquisition coil is open on at least one side, thereby generating a gap (7) that can be opened and then closed again.

2. *(amended)* A current acquisition coil according to claim 1, **[characterized in that the structure of]** **wherein** the coil **[consists of]** **comprises** two annular printed circuit board segments (1, 10), which are **[each]** connected **[with]** **to** each other on one side by a hinge (6).

3. *(amended)* A current acquisition coil according to claim 1 or 2, **[characterized in that]** **wherein** the printed conductor ends (13) of the coil winding on **[the]** **a** first printed circuit board segment (1) are connected by means of flexible conductors (12) with the printed conductor ends (13) of the coil winding on **[the]** **a** second printed circuit board segment (10).

4. *(amended)* A current acquisition coil according to claim 1, **[characterized in that the structure of]** **wherein** the coil **[consists of]** **comprises** a single-piece, **[slit]** **slitted,** and twistable printed circuit board segment (1).

5. *(amended)* A current acquisition coil according to **[one of the preceding claims, characterized in that]** **claim 1, 2, 3, or 4, wherein** the printed circuit board (1, or 1 and 10) of the current acquisition coil is built around several layers.

6. *(amended)* A current acquisition coil according to claim 5, **[characterized in that]** **wherein** two layers are provided for the printed conductors of **[the]** **an** incoming winding (22, 22a, 23, 23a), and two additional layers are provided for the printed conductors of **[the]** **a** returning winding (24, 24a, 25, 25a).

7. *(amended)* A current acquisition coil according to **[one of the preceding claims, characterized in that the]** **claim 1, 2, 3, 4, 5, or 6, wherein** components for an electronic circuit (19) are arranged on the printed circuit board (1).

8. *(amended)* A current acquisition coil according to the Rogowski principle with printed conductors (22, 23, 24, 25), whose arrangement yields a coil winding (20, 21), and whose printed conductor ends are connected **[with]** **to** each other by through platings (26, 27, 28, 29) on **[the]** **a** printed circuit board (1, 10), **[characterized in that the]**

wherein a printed circuit board for **[the] a** conductor to be measured accommodates electrical terminals (56), which are connected **[with] to** each other via printed conductors (52, 54) and at least one through plating (53) in an axial direction in **[the] a** center of the coil.

9. *(amended)* A current acquisition coil according to claim 8, **[characterized in that] wherein** the printed circuit board (1, or 1 and 10) of the current acquisition coil is built around several layers.

10. *(amended)* A current acquisition coil according to claim 9, **[characterized in that] wherein** two layers are provided for the printed conductors of **[the] an** incoming winding (22, 22a, 23, 23a), and two additional layers are provided for the printed conductors of **[the] a** returning winding (24, 24a, 25, 25a).

11. *(amended)* A current acquisition coil according to **[one of the claims 8 to 10, characterized in that the] claim 8, 9, or 10, wherein** components for an electronic circuit (19) are arranged on the printed circuit board (1).